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Title: Wedding Cake Experiments Design and Data Packages Version 2

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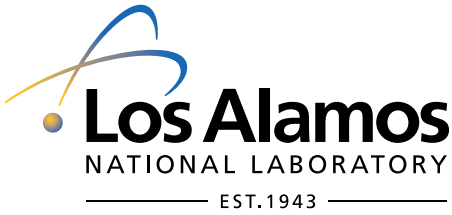

XTD-NTA Nuclear Threat Assessment

LA-UR-20-

Wedding Cake Experiments Design and Data Packages Version 2

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This report documents the design and data for four related experiments known as the Wedding Cake shots. It is a revised version of LA-UR-17-28352.

The basic designs of these four shots are the same. A high-explosive plane-wave lens launches a flyer towards an acceptor material with a smaller diameter. This acceptor is either another piece of high-explosive or a piece of polyethylene. A detonation or shock wave propagates through this material and launches a second flyer. The velocities of both flyers are recorded using Photon Doppler Velocimetry (PDV). The overall shape of the shots is reminiscent of a tiered wedding cake and, consequently, these shots are know as the Wedding Cake shots. Details of the shot assembly are shown in the Wedding Cake Assembly Drawing and component drawings that accompany this report. The design differences among the four shots (the acceptor material and the second flyer design) are given in Table 1. Note that one of the shots was never fired; it is mentioned merely out of a desire for completeness.

Shot number	Shot Date	Acceptor Material	Second Flyer
R306-23134	November 12, 2014	PBX-9501	304 Stainless, 2.0 mm thick
R306-23135	not fired	Low Density Polyethylene	304 Stainless, 2.0 mm thick
R306-24201	November 10, 2015	PBX-9501	Tantalum, 0.040 inches thick
R306-24202	November 10, 2015	Low Density Polyethylene	Tantalum, 0.040 inches thick

Table 1: Summary of differences among four Wedding Cake shots.

Five PDV probes were installed on the "PDV Plate" and three were installed on "Barrel 2". The five probes on the PDV Plate interrogated the velocity of the acceptor flyer while the three on Barrel 2 interrogated the donor flyer. On the PDV Plate, the probes were installed along the single line of 0.096" diameter holes that is shown as horizontal in the drawing. The probes were numbered, going from left to right, probe 5, probe 4, probe 1, probe 2, and probe 3. Four of the probe holes in the line were left empty such that occupied and unoccupied holes alternated. Thus, probe 1 occupied the center hole, probes 5 and 3 occupied the outermost holes and probes 2 and 4 occupied holes halfway between the outermost and center holes.

PDV probes 6, 7 and 8 were installed on the three small holes on Barrel 2; however the clocking order was not recorded. The PDV Plate and Barrel 2 are aligned such that the 0.375" clearance holes are constrained by the Base Plate to be on the same radial lines. There are thus six possible permutations of probe locations (relative to the probes on the PDV plate) possible on Barrel 2. Unfortunately, the identity of the combination that was fielded was not preserved.

Velocity versus time data determined from the PDV probes for the three conducted experiments are recorded in CSV files. Channels 1 through 5 are from probes mounted on the PDV plate as described above while channels 6 through 8 are from probes mounted on Barrel 2. Data from all of the PDV probes on a given shot were recorded with a common time base. The filenames and md5 checksums for the four data files are:

`R306-23134_Ch1-5_PDV_data.csv`	f43f74dc63e6073f209c14ac3499e544
`R306-23134_Ch6-8_PDV_data.csv`	3183cbd2a39a6660c902b23e0b4e43d2
`R306-24201_Ch1-8_PDV_data.csv`	4821d35345a7ef1077cbca1c6ff977ed
`R306-24202_Ch1-8_PDV_data.csv`	7d0b58b6cc504393b9753f2744ef33da

The four files were compressed into a single "zip" file with md5 checksum:

`Wedding_Cake_PDV_Data.zip`	2ff1c8994c55b27c779cb08eaf5da13e

The signals returned from channels 1 through 5 for experiment R306-23134 between 43.0 μs and 45.5 μs were very weak and the evaluated velocities should be considered suspect.

No material specifications are available for the components used. No inspections of components or the experimental assembly were performed beyond casual visual inspection.

Photos of the experiment and drawings as well as drawings are provided as individual files in the following "zip" files (with md5 checksums):

`Wedding_Cake_Photos.zip`	226b138fe951bdc4ccaae15933bb2e18
`Wedding_Cake_Drawings.zip`	4c5287a343fa90d7e65431f400c6a8ac

Changes from Version 1: In Version 1 of this report, the erroneous listing of shot R306-23134 as R306-23234 in several places has been corrected. The description of the relative ordering of the PDV probes was clarified. The figures of drawings were removed from the report and references were directed to accompanying drawings where needed; a revised issue of the drawings has been included with the report as well. Photos were also removed from the report and now accompany the report. The names of the "zip" file containing the PDV data as well as the PDV data files were changed for consistency. Text identifying the PDV probe channel numbers and a comment about the PDV probe time base were added.